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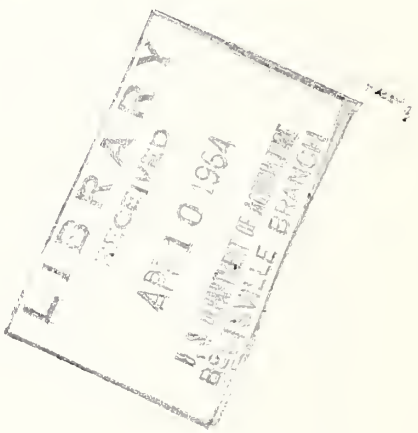
# REPORT

## of the

# NINETEENTH NORTHEASTERN CORN IMPROVEMENT CONFERENCE

New York City
February 21-22, 1964

Reported by
G. F. Sprague, Secretary




Crops Research Division
Agricultural Research Service
United States Department of Agriculture
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# REPORT OF THE NINETEENTH NORTHEASTERN CORN IMPROVEMENT CONFERENCE

New York City, N. Y.
February 21-22, 1964

## MORNING SESSION, February 21

The meeting of the Northeastern Corn Improvement Conference was called to order by Chairman W. I. Thomas at 9:00 a. m. Following introductions the Chairman appointed a nominating committee, consisting of D. L. Matthews, H. L. Everett and J. C. Anderson, to select candidates for Vice-Chairman for 1965.

The Conference then received reports from the several standing committees. These reports are presented in the following sections.

## REPORT OF THE COMMITTEE ON THE UNIFORM TESTS OF 100-300 MATURITY

Seed of some 100 double crosses was produced in 1963, 25 at Ottawa and approximately 75 at Pennsylvania. A list of the Ottawa crosses and the earliest of the Pennsylvania crosses is attached. Seed for test plantings in 1964 can be obtained from the appropriate institutions upon request.

Inbreds involved in these double crosses are C0109, C0113, C0125, C0150 C0158, C0159, PA32, Q163, A495 and A509. Double crosses produced were selected on the basis of predictions made from 1962 single cross test data from Quebec, Pennsylvania and Cornell.

R. M. Bailey
R. I. Brawn
H. L. Everett
W. I. Thomas
L. S. Donovan, Chairman

Double Cross Hybrids in the 100-300 Maturity Range made at Ottawa in 1963.

| | | | |
|---|---|---|---|
| 1 | (CO113 x CO125) | x | (CO109 x Q163) |
| 2 | (CO113 x CO150) | x | (CO109 x Q163) |
| 3 | (CO113 x PA32) | x | (CO109 x Q163) |
| 4 | (CO113 x A509) | x | (CO109 x Q163) |
| 5 | (CO109 x Q163) | x | (CO125 x CO150) |
| 6 | (CO109 x Q163) | x | (CO125 x A495) |
| 7 | (CO109 x Q163) | x | (CO125 x PA32) |
| 8 | (CO109 x Q163) | x | (CO125 x A509) |
| 9 | (CO109 x Q163) | x | (CO150 x A509) |
| 10 | (CO109 x A495) | x | (CO113 x Q163) |
| 11 | (Q163 x PA32) | x | (CO109 x A495) |
| 12 | (CO109 x A495) | x | (CO113 x CO125) |
| 13 | (CO109 x A495) | x | (CO125 x A509) |
| 14 | (CO109 x A495) | x | (CO158 x A509) |
| 15 | (CO109 x PA32) | x | (CO113 x A509) |
| 16 | (CO109 x PA32) | x | (CO158 x A509) |
| 17 | (CO109 x PA32) | x | (Q163 x A495) |
| 18 | (CO109 x PA32) | x | (A495 x A509) |
| 19 | (CO109 x A509) | x | (CO113 x Q163) |
| 20 | (CO109 x A509) | x | (Q163 x PA32) |
| 21 | (CO158 x A509) | x | (CO125 x CO109) |
| 22 | (CO113 x CO150) | x | (CO125 x CO109) |
| 23 | (CO150 x CO158) | x | (CO125 x CO109) |
| 24 | (CO150 x Q163) | x | (CO125 x CO109) |
| 25 | (CO125 x Q163) | x | (CO109 x CO150) |

Seed of each for 1964 tests is available upon request.

Double crosses made in Pennsylvania in 1963 from predictions of 1962 single cross data.

(CO 150 X A 509)(CO 109 X PA 32)
(CO 109 X A 495)(PA 32 X A 509)
(CO 125 X A 509)(CO 109 X PA 32)
(CO 113 X A 509)(CO 109 X A 495)
(CO 113 X CO 158)(CO 109 X A 495)
(CO 158 X A 509)(CO 109 X A 495)
(CO 150 X A 509)(CO 109 X Q 163)
(CO 158 X PA 32)(CO 109 X A 509)
(CO 125 X CO 109)(Q 163 X PA 32)
(CO 125 X CO 109)(CO 150 X PA 32)
(CO 158 X A 509)(CO 158 X CO 109)
(CO 125 X PA 32)(CO 109 X A 509)
(C 153 X PA 409)(PA 55 X NY 821)
(C 153 X PA 409)(W 182D X NY 821)

Committee on Uniform Tests of 300-500 Maturity

Two diallel series of single crosses were tested cooperatively in 1963. Test locations for group I inbreds included Massachusetts (Amherst and Eastern States Farmers' Exchange (ESFE) at Feeding Hills), Michigan (average of two counties: Saginaw and Ingham), New York (Aurora Farm-Cayuga County), and Pennsylvania (average of two locations: Centre Hall and Bloomsburg).

Table I contains the yield averages for the ten inbreds in all-combinations at five locations. Also shown are overall averages for yield and moisture content.

TABLE 1. Average yields in bushels per acre for all combinations of the parental lines involved in the Group I diallel series.

| Inbred | Overall Average Yield | Overall Average Moisture Content | Location: (1) Mass Amherst | (2) ESFE | (3) Mich. | (4) New York | (5) Penna. |
|---|---|---|---|---|---|---|---|
| N.Y.821 | 89.0 | 27.9 | 125.4 | 95.8 | 73.3 | 72.7 | 77.8 |
| N.Y.511 | 86.4 | 23.9 | 112.1 | 89.9 | 64.9 | 83.3 | 81.6 |
| Pa. 41 | 86.4 | 27.1 | 103.8 | 76.0 | 70.9 | 78.0 | 103.2 |
| W144 | 85.9 | 28.2 | 121.0 | 90.8 | 71.5 | 70.5 | 75.5 |
| C153 | 84.1 | 25.7 | 104.4 | 89.5 | 69.9 | 81.6 | 74.9 |
| MSA2 | 82.2 | 29.9 | 120.7 | 85.0 | 69.4 | 78.3 | 57.4 |
| N.Y.N22 | 81.0 | 31.9 | 112.5 | 59.0 | 70.2 | 74.6 | 88.6 |
| A495 | 78.7 | 24.9 | 97.1 | 82.8 | 66.6 | 78.3 | 68.7 |
| WA374 | 77.2 | 28.4 | 109.7 | 81.7 | 70.5 | 66.3 | 71.4 |
| ND230 | 67.7 | 24.1 | 84.1 | 87.0 | 55.8 | 79.8 | 31.7 |

Table 2 lists the top 15 sincle crosses by yield and moisture content (Average of all locations) and presents yields of each location.

Table 2. Yields in bushels per acre and average moisture percentage for the highest yielding 15 single crosses of the group I diallel series.

| | Single Cross Entry | Average Yield | $H_2O$ | (1) ESFE | (2) Mass Amherst | (3) Mich. | (4) New York | (5) Penna. |
|---|---|---|---|---|---|---|---|---|
| (1) | NY511xNY821 | 100.5 | 23.0 | 111.0 | 135.8 | 69.6 | 85.4 | 101.5 |
| (2) | Pa41xNY821 | 99.0 | 29.4 | - | 136.5 | 81.7 | 81.2 | 96.4 |
| (3) | Pa41xNY511 | 95.0 | 24.0 | - | 137.0 | 68.0 | 89.4 | 85.5 |
| (4) | NYN22xNY511 | 94.1 | 27.0 | 90.0 | 124.8 | 71.3 | 86.0 | 98.2 |
| (5) | NYN22xNY821 | 93.5 | 35.3 | - | 133.9 | 82.2 | 67.2 | 90.5 |
| (6) | MSA2xC153 | 92.7 | 29.7 | - | 118.7 | 89.3 | 75.8 | 86.9 |
| (7) | C153xNY821 | 92.5 | 24.0 | - | 123.5 | 68.9 | 81.5 | 96.0 |
| (8) | Pa41xC153 | 91.1 | 26.0 | - | 120.2 | 87.4 | 85.7 | 71.2 |
| (9) | W144xNY511 | 90.6 | 24.7 | 90.0 | 119.3 | 69.4 | 84.6 | 89.6 |
| (10) | W144xNY821 | 90.5 | 29.2 | 110.0 | 132.3 | 72.2 | 58.8 | 79.1 |
| (11) | W144xPa41 | 90.1 | 27.1 | 93.0 | 127.9 | 74.4 | 70.3 | 84.7 |
| (12) | MSA2xPa41 | 89.5 | 31.3 | - | 124.1 | 72.9 | 74.8 | 86.2 |
| (13) | W144xNYN22 | 89.3 | 35.7 | - | 134.9 | 69.7 | 69.6 | 83.0 |
| (14) | Pa41xWA374 | 87.8 | 27.7 | 88.0 | 116.3 | 78.3 | 69.0 | 87.3 |
| (15) | MSA 2xNY511 | 87.6 | 26.4 | 88.0 | 120.2 | 70.9 | 74.4 | 84.4 |

Table 3. Average yield and moisture content for single crosses ranking 16th to 45th in the Group I diallel series.

| | Entry | Yield | $H_2O$ | | Entry | Yield | $H_2O$ |
|---|---|---|---|---|---|---|---|
| (16) | MSA2xNY821 | 87.2 | 26.2 | (31) | NYN22xMSA2 | 79.2 | 35.6 |
| (17) | W144xA495 | 87.5 | 33.2 | (32) | A495xWA374 | 77.9 | 23.0 |
| (18) | A495xNY821 | 86.9 | 25.7 | (33) | W144xND230 | 76.6 | 26.1 |
| (19) | W144xC153 | 86.2 | 24.5 | (34) | A495xMSA2 | 75.1 | 30.8 |
| (20) | NYN22xC153 | 83.7 | 31.5 | (35) | NYN22xWA374 | 74.6 | 35.7 |
| (21) | W144xMSA2 | 83.5 | 27.3 | (36) | A495xNYN22 | 73.9 | 27.9 |
| (22) | NY511xC153 | 81.2 | 22.7 | (37) | Pa41xND230 | 73.3 | 23.5 |
| (23) | WA374xC153 | 81.0 | 27.9 | (38) | NYN22xPa41 | 72.6 | 29.0 |
| (24) | WA374xNY511 | 80.6 | 24.6 | (39) | ND230xNY821 | 70.9 | 22.8 |
| (25) | A495xNY511 | 80.2 | 21.5 | (40) | ND230xC153 | 68.0 | 22.5 |
| (26) | A495xC153 | 80.1 | 22.7 | (41) | NYN22xND230 | 67.9 | 29.1 |
| (27) | MSA2xWA374 | 80.0 | 30.8 | (42) | ND230xNY511 | 67.8 | 21.6 |
| (28) | W144xWA374 | 79.4 | 33.1 | (43) | A495xND230 | 67.5 | 21.0 |
| (29) | A495xPa41 | 79.3 | 25.7 | (44) | MSA2xND230 | 62.6 | 24.4 |
| (30) | WA374xNY821 | 79.3 | 28.7 | (45) | WA374xND230 | 54.3 | 23.7 |

Table 4. The highest yielding double-crosses predicted on the basis of single-cross performance of the Group I diallel series.

| Predicted Double | Yield Bu/A. | Moisture % Content |
|---|---|---|
| (1) (NY821xNY511) (NYN22xPa41) | 95.4 | 29.0 |
| (2) (NY821xPa41) (C153xNY511) | 94.8 | 24.3 |
| (3) (W144xPa41) (NY821xNY511) | 93.8 | 26.8 |
| (4) (C153xPa41) (NY821xMSA2) | 93.4 | 28.6 |
| (5) (MSA2xPa41) (NY821xNY511) | 92.3 | 28.3 |
| (6) (W144xNYN22) (NY821xNY511) | 92.2 | 29.1 |
| (7) (W144xNY511) (NYN22xPa41) | 92.2 | 28.5 |
| (8) (W144xNY821) (C153xPa41) | 92.0 | 26.3 |
| (9) (NY821xNY511) (C153xPa41) | 91.9 | 25.3 |
| (10) (NY511xPa41) (NY821xNYN22) | 91.3 | 27.4 |
| (11) (NYN22xMSA2) (NY821xNY511) | 90.7 | 30.5 |
| (12) NY821xNY511) (C153xNYN22) | 90.4 | 27.3 |

The second diallel series - group 2 was grown cooperatively in Pennsylvania and New York. The performance record of these inbreds is presented in table 5.

Table 5. Average yield in bushels per acre for all combinations of the parental lines involved in the Group II diallel series.

| Inbred | Overall Averages Yield | Moisture % Content | Yield in New York | Penna. |
|---|---|---|---|---|
| (1) W64A | 79.7 | 29.0 | 71.9 | 87.7 |
| (2) NYD410 | 79.0 | 27.3 | 73.5 | 84.4 |
| (3) ES191-71 | 78.3 | 24.7 | 74.4 | 82.1 |
| (4) B8 | 78.2 | 23.9 | 74.9 | 81.5 |
| (5) MS116 | 77.8 | 25.8 | 74.7 | 81.0 |
| (6) Pa.405 | 77.8 | 23.9 | 68.0 | 87.6 |
| (7) A297 | 77.2 | 27.8 | 65.0 | 90.1 |
| (8) NYN22 | 76.5 | 29.7 | 67.1 | 85.8 |
| (9) A401 | 75.4 | 25.1 | 65.4 | 85.6 |
| (10) Pa37 | 75.3 | 25.5 | 71.5 | 79.1 |
| (11) NYD16 | 71.6 | 24.0 | 67.1 | 76.2 |
| (12) MS109 | 69.9 | 32.3 | 60.5 | 79.3 |

The top twenty singles from group 2 are listed with yield and moisture average in table 6.

Table 6. The twenty highest-yielding single crosses from the Group II diallel series.

| | Cross | Yield | Moisture % | | Cross | Yield | Moisture % |
|---|---|---|---|---|---|---|---|
| (1) | Pa.405xW64A | 88.9 | 24.8 | (11) | ES119-71xW64A | 81.8 | 28.4 |
| (2) | Pa37xNYD410 | 86.6 | 23.3 | (12) | B8xPa405 | 81.7 | 19.1 |
| (3) | Pa405xES191-71 | 84.5 | 24.8 | (13) | B8xNYD410 | 81.1 | 24.8 |
| (4) | A297xW64A | 84.1 | 28.6 | (14) | B8xES191-71 | 81.1 | 22.0 |
| (5) | NYD410xES191-71 | 83.3 | 27.9 | (15) | NYN22xES191-71 | 81.0 | 25.7 |
| (6) | B8xW64A | 82.8 | 24.3 | (16) | NYD410xA297 | 80.9 | 29.9 |
| (7) | B8xA401 | 82.5 | 22.5 | (17) | NYN22xW64A | 80.7 | 33.1 |
| (8) | ES191-71xMS116 | 82.0 | 23.2 | (18) | Pa37xNYN22 | 80.7 | 27.6 |
| (9) | W64AxMS116 | 82.0 | 27.7 | (19) | A401xW64A | 80.6 | 30.2 |
| (10) | NYN22xMS116 | 81.9 | 30.8 | (20) | Pa37xPa405 | 80.5 | 24.0 |

G. W. Gorsline
C. E. Manchester
H. M. Yegian
H. L. Everett, Chairman

## REPORT OF THE COMMITTEE ON THE UNIFORM TESTS OF HYBRIDS OF 700-900 MATURITY

A series of double-crosses of 700-900 maturity were compared in Pennsylvania, New Jersey and Maryland in 1963. The yields were affected by drought at each location. Copies of the data were supplied each cooperator and other interested parties so the data will not be presented here. No other regional tests were conducted involving the 700-900 maturity series.

J. G. Buchert
R. G. Rothgeb
W. I. Thomas
J. C. Anderson, Chairman

## REPORT OF THE COMMITTEE ON DISEASES AND PESTS

No cooperative research on diseases and/or pests of corn was conducted in 1963 in the northeast. Funds for a cooperative regional research project on stalk and root rot were not available. Some general observations on diseases and pests were made by members of the northeast group and a summary of these observations follows.

Some observations on diseases and pests of corn in 1963 made by members of the Northeastern Corn Improvement Conference make interesting reading. Many of the observations were made in local areas and do not necessarily represent a statewide situation, but they do give a general picture of the disease and pest problems in the northeast for that year.

The number one problem in 1963 seems to have been bird damage (crows, starlings, redwing blackbirds, etc.). In Ottawa and Quebec, Canada birds were in fields early pulling up seed and seedlings, and they came back in late season "to strip the last of the grain". They appeared to be a limiting factor in the expansion of grain corn growing in the Quebec area. In Maine birds were reported as "increasingly severe", in New Hampshire a grain corn trial was not harvested because of bird damage, and in Massachusetts birds

were a big problem at both ends of the season. Damage was fairly heavy in Maryland, New York and Pennsylvania. In New Jersey birds continued to be serious pests, particularly along the Delaware River and Bay. In West Virginia redwing blackbirds appeared early and crows feasted on corn in the milk and soft dough stage later. The nursery in Virginia was protected with crocks of soaked corn at planting and by shot guns in the fall.

Racoons were a serious problem in Quebec, in northern Vermont, and in Northeastern Ohio. There were light to moderate infestations of corn borer throughout the northeast but these were actually fewer than in other years. The borer seems to be on the wane in the Quebec area in comparison to the situation 10-15 years ago. Corn earworm damage was slight except in eastern Virginia. Heavy corn rootworm damage was found in some fields in the New York Hudson Valley area, and spotty infestations in western New York. Aphids appeared in greater quantities than in previous years, particularly in Massachusetts, Maryland, New Jersey and Pennsylvania and the Japanese beetle was still causing trouble in West Virginia and increasing somewhat in Virginia. Rice weevils and grain moths were problems in Virginia but only in the extreme Southern Piedmont and Southeastern areas of the state.

The stalk and root rot disease, usually a real problem in the northeast, occurred in light to moderate amounts in 1963. The overall severity pattern was the same, however, the greatest amounts occurring in the southern portion of the region. The disease in one plot in Delaware was actually worse than in most places in the northeast in an average year. Very little stalk rot was reported in Maine, New Hampshire and in Northern New York.

Little if any Helminthosporium leaf blight was observed in Canada or in the northern portion of the northeast region, although moderately heavy spots did show up in one upstate area in New York and in the Hudson Valley. Traces of the blight were seen in Maryland, New York and Pennsylvania and only slight to moderate amounts developed in Virginia and West Virginia. Corn smut, on the other hand, was somewhat worse than usual in Canada and in the northeastern states. All observers reported a higher incidence of the disease, although they indicated that the overall amount was not particularly damaging to yield.

Seedling blight and seed decay were relatively light, primarily because of light rainfall at planting time, even though it was cool. Rust was not a problem. The appearance of corn stunt in the central corn region made cooperators alert to the possibility of its occurrence in the northeast. Two suspicions of the disease were reported, but actual confirmation of stunt in these localities was not made. One was in a cooperative project trial in Lucasville, Ohio and the other in Virginia.

A new problem, red stripe, showed up this year in several field plots located in Ohio and Pennsylvania. This condition, common throughout many areas in the midwest in 1963, was characterized by a reddish striping

of the kernels, sometimes slight, sometimes heavy. No disease agent could be implicated. An unusual sequence of environmental factors, e.g., temperatures, moisture, and intense sunlight, is thought to have been responsible for expression of the reddening.

The following cooperators submitted data: L. S. Donovan, Ottawa, Canada; R. Braun, Montreal, Canada; R. M. Bailey, Maine; P. T. Blood, New Hampshire; J. Buchert and C. E. Manchester, Massachusetts; C. W. Boothroyd and H. L. Everett, New York; C. C. Wernham and H. Cole, Pennsylvania; J. C. Anderson, New Jersey; G. F. Sprague and R. G. Rothgeb, Maryland; M. W. Johnson, West Virginia; and C. F. Genter, Virginia. Rossman, Michigan, also kindly submitted some general observations and it was interesting to note that, other than the perennial corn rootworm and the new red stripe problem, diseases and pests in Michigan were comparable to those in the northeast in 1963. Stalk rot and blight were not as bad as usual, smut was worse, and birds were a real problem around lakes and wooded areas.

J. C. Anderson
M. W. Johnson
R. G. Rothgeb
C. C. Wernham
C. W. Bothroyd, Chairman

Report of the Committee on Corn Silage Research

Pennsylvania

Comparison of 25-50-100 thousand plant populations of two double-crosses, one single-cross and their $F_2$'s were continued. Losses in dry matter per acre ranged from 3% at 100,000 plants per acre to 15% at 25,000 plants per acre when comparing $F_2$'s to the $F_1$'s of the double crosses. Losses with the $F_2$'s of the single crosses were greater than with the double-crosses. Maximum Dry Matter was obtained at 50,000 plants per acre. Dry weather in the past two years has not resulted in lodging losses at the high plant populations as has occurred in some years. Consequently more information with adequate moisture is desired.

Plot silage yields involving hybrids grown with and without grain formation indicate an approximate 20 per cent reduction in total dry matter yield when grain formation was prevented. Hand refractometer readings indicated that under good growing conditions, stalk sugar increased over 50 per cent when grain formation was prevented. Under less desirable conditions, stalk sugar increased from 15 to 20 per cent.

A conventional one-row silage field chopper was modified for use in harvesting approximately 1000 silage plots in 1963. A comparison of the accuracy of this method to that of previous hand-harvested plots is being made. No data is available at present.

Evaluation of silage yield, per cent stalk sugar, proximate TDN analyses and other measurements of a diallel set of single crosses and an array of predicted double crosses is being continued. Information from these data will be completed in 1964.

CCRP

Commercial and experimental hybrids were evaluated for silage yield at a population of 19,000 plants per acre.

Three hybrids--M3, Pa 444, and W335A--were compared at population levels of

21 M, 25 M, and 29M. The location harvested was in a droughty area; the other location was unharvestable because of raccoon damage. Maximum yields were at the 21 M level. Over all populations, M-3 was the highest yielding, though W 335A gave equivalent results at 21 M. Superior performance of Cornell M-3 at the higher populations was due to higher grain yield.

New Jersey

Comparisons of barren vs. normal corn grown for silage in 1963 showed that the barren plots yielded 88% as much TDN as their normally eared counterparts. Details of this report are presented in the paper session of this Conference.

West Virginia

Corn for silage evaluation in animal feeding trials was produced in 1963, and is being stored pending availability of animal nitrition facilities.

Ottawa

The Dairy Department is conducting the final year of a three year feeding trial of silage produced by Pride 5, an early variety, and Warwick 605, a late variety.

MacDonald

Silage trials continue to show high dry matter potential of late season materials. Dr. Brown emphasized the need for data on silage quality through animal trials.

New York

Hybrids of three maturity groupings were evaluated in row trials at 19 M population for yield of dry matter, percent of grain, and calculated TDN.

Five varieties, including sudangrass, sorghum, and sudan-sorghum hybrids, were produced in 1963 on approx. one acre blocks to produce materials for checking comparative digestibility and palatability values obtained in animal trials with sheep and dairy animals. Two oat varieties were also harvested as forage in 1963.

for this comparison, and forage from corn hybrids grown under high populations will be included in the study. Research will focus upon correlations of results between the two animal species, as well as upon comparisons among the annual grasses.

An evaluation of corn silage with milking cows at the Canton ATI farm is nearing completion. The basic objectives are:

1. Obtain silage production data (yield per acre) for two corn hybrids - Pa. 290 and H.S. 50.
2. Compare the feeding value of the two corn silages.
3. Compare corn silage as a forage source with alfalfa hay.

Approximately three acres each of Pa. 290 and H.S. 50 were grown and ensiled, and several tons of second-cut alfalfa hay were made available for the trial. Twenty-four lactating Holstein cows are being fed in four groups of six, using a switchback design. Data will be compiled, interpreted, and reported by spring, 1964.

Incidental to the research has been experience in construction and use of octagonal plywood silos with plastic liners, capacity approx. twenty-five tons.

Regional Project

A copy of the proposal for a regional project on corn silage, "Breeding and Evaluation of Silage Corn Varieties for the Northeast" was distributed in April, 1963 to members of NECIC and all Experiment Station Directors. On the basis of replies received, a revised draft was prepared and mailed in August, 1963. Three states not now active in the NECIC have expressed interest in participation in silage evaluations. The Central Experimental farms, Ottawa, and MacDonald College, as well as the Cooperative Corn Research Project, are interested in continued cooperation within the project objectives and procedures.

## REPORT OF THE COMMITTEE ON NOMENCLATURE OF CYTOPLASMIC STERILITY

No report was submitted from this committee.

## REPORT OF THE COMMITTEE ON INBRED RELEASE POLICY

No report was submitted from this committee.

## REPORT OF THE COMMITTEE ON THE REGISTRATION OF N.E. HYBRIDS

No report was submitted from this committee.

## REPORT OF THE COMMITTEE ON POLLINATING SUPPLIES

65,000 tassel bags, purchased from the Michael J. Biggins Company, Peoria, Illinois, were distributed among three conference members, plus the Pennsylvania Foundation Seed Cooperative in 1963. The specifications of these bags were 7 x 4 3/4 x 15 3/4 LE, 40# wet strength - one ply waterproof adhesive throughtout - plain. Cost was $7.80/M FOB, Flora, Indiana plant.

We are especially indebted to Dr. Clifford Wernham, Department of Botany and Plant Pathology, Pennsylvania State University for accepting delivery of the entire order and re-distributing the bags to individual purchasers.

| Year | ♀ (000) | ♂ (000) | No. Members Participating |
|---|---|---|---|
| 1956 | 350 | --- | 4 |
| 1957 | --- | 283 | 5 |
| 1958 | 365 | --- | 8 |
| 1959 | --- | 200 | 5 |
| 1960 | 275 | -- | 8 |
| 1961 | --- | 151 | 5 |
| 1962 | 258 | --- | 7 |
| 1963 | --- | 65 | 3 |

A glance at the above table shows that the cooperative purchase of pollinating supplies by NECIC members is declining. This decline closely follows the improved availability of high quality supplies from commercial sources.

It seems apparent that the NECIC Committee on Pollinating Supplies no longer serves a truely useful purpose. It is my recommendation that this committee be retired.

D. L. Matthews, Chairman

It was MOVED by D. L. Matthews and seconded by J. C. Anderson that: "While the Committee on Pollinating Supplies has served a useful function it no longer serves a necessary function and the committee should be retired."

The motion PASSED.

AFTERNOON SESSION, February 21

## Present Status of Corn Stunt Disease

Karl Maramorosch

A new disease, assumed by many to be corn stunt, has appeared in increasing quantities in Louisiana, Mississippi and southern Ohio in the past two years. Leafhoppers (Dalbulus maidis) reared by Maramorosch in the laboraboty at Boyce Thompson Institute were fed on diseased leaves of corn from Mississippi in 1962 and these insects transferred the stunt virus to healthy corn seedlings. Similar tests with leaves from stunted plants collected in Ohio in the fall of 1963, however, have failed to date to confirm the presence of this virus disease.

This does not necessarily mean that the diseased condition in the Ohio region is not corn stunt. It is known that this leafhopper is a very efficient vector of the stunt virus, however, and failure to get ready transmission suggests that the problem in Ohio may be another disease. In support of this suspicion are data that a virus has been transmitted mechanically from leaves of stunted corn plants in Ohio to leaves of sorghum. The true corn stunt virus, by contrast, has never been shown to have been transmitted mechanically to any plant, and in addition, the corn stunt virus has been transmitted by leafhoppers only to two plants, corn and teosinte.

A series of slides demonstrated beautifully the typical symptoms of the two known strains of the stunt virus in corn found in Latin America, the stunting and chlorotic streaking of one strain and a stunting and pronounced leaf reddening and purpling of the other strain. The symptoms of diseased plants in Ohio resembled those of the latter most closely.

Dalbulus maidis or D. elimatus, known leafhopper vectors, have not as yet been shown to be present in Ohio. This raises the question of whether the insects have been brought into that region, whether they could survive as far north as Ohio if they were, and whether or not one or more other insect species may be involved in transmission. Dalbulus when found seems to prefer the innermost depths of the corn whorl for feeding.

Several interesting experiments with this disease and its vector have been carried out by Maramorosch at Boyce Thompson and elsewhere, e.g., transmission of the stunt virus to its insect vector, use of basic fuchsin dye on the vector's wings for easy detection, radioactive carbon and phosphorus tracers in feeding experiments on corn and other plants, and the use of gibberellic acid on stunted plants to stimulate normal plant growth. Cross protection tests with both species of the Dalbulus vector have shown that there are two strains of the corn stunt virus. There may be other strains also. Whether or not the new disease in Ohio is corn stunt has yet to be determined, althought the presence of this disease in Louisiana and Mississippi has been pretty well documented. It is a potentially serious disease and certainly many research workers will be trying to determine the true cause and develop control measures for it this season.

## Genetic Control of Carbohydrate Synthesis

R. G. Creech

Gross differences have been observed between several mutant (ae, du, $sh_2$, $su_1$, $su_2$m abd wx) and normal kernels for carbohydrate type (reducing sugars, sucrose, water soluble polysaccharides, amylose, amylopectin, and total starch) and quantity; starch granule shape, size, and frequency; and for activities of specific enzymes. It is proposed that amylose and amylopectin starch are synthesized by at least three separate biochemical pathways. Detailed chemical analyses are now required before a secure scheme of synthesis can be presented.

Several genotypes (ae $su_1$ wx, ae du wx, ae du $su_1$, ae wx, and $sh_2$) show promise for possible use in sweet corn quality improvement and are being utilized on a pilot basis by several investigators.

These studies are expected to lead into areas of enzyme characterization, localization of activity, aspects of enzyme synthesis, and finally the control mechanisms involved in the synthesis of polysaccharides in maize endosperm, including possibly enzyme repression and activation.

## Barren vs. Normal Corn for Silage

J. C. Anderson

Comparison of barren virus normal silage were conducted in New Jersey and Pennsylvania. In some areas of New Jersey bird damage is severe ranging up to 60 percent or more of potential grain yield. Under such conditions comparative yields of barren and normal corn, harvested for silage, becomes of interest. The 1963 data obtained in New Jersey are presented in table 7. As an over-all average the TDN per acre for barren corn was 88 percent of normal.

## Barren vs. Normal Corn for Silage

W. F. Craig, W. I. Thomas and J. W. Bratzler
in Pennsylvania

During the summer of 1962, two plots of corn were grown specifically for the purpose of ensiling in eight experimental silos and subsequent feeding trials of the ensiled materials to mature wether sheep.

The two plots, one in isolation from any pollen source and the other located so as to be adequately pollinated, were planted to each of two male sterile hybrids, H.S. 50 and Wf 9 x Hy. The eight ensiled materials were as follows:

HS 50 with ears from non-isolated field

HS 50 without ears from non-isolated field

Wf 9 x Hy with ears from non-isolated field

Wf 9 x Hy without ears from non-isolated field

HS 50 with cobs from isolated field

HS 50 without cobs from isolated field

Wf 9 x Hy with cobs from isolated field

Wf 9 x Hy without cobs from isolated field.

Materials were harvested and chopped with a coventional field forage harvester as near ideal silage stage as possible. Refractometer readings of total stalk sugars were made from each hybrid plot at harvest time. These data are presented in table 8.

Feeding trials were conducted by Dr. John W. Bratzler, Department of Animal Industry and Nutrition, Pennsylvania State University. These data are presented in table 9. In each case, except one, where ears or cobs were included, the digestible dry matter, digestible protein, and digestible energy was greater. In all cases more energy as calories per kilogram of dry matter was found with the ears or cobs present. HS 50 compared to Wf 9 x Hy performed relatively the same both with and without grain formation with only minor variations.

Information contained in table 10 is that from the chemical proximate analysis of the eight materials both as green chop and fermented silages. Again only minor differences occur between hybrids.

It is apparent from these data that from a nutritional view point the best ensilage was obtained from the entire plant when grain formation was permitted. However, it is also apparent that the value of silage produced under isolated conditions when grain was not permitted to form was slightly superior to silage made from only the stalks and leaves either when grain formation was permitted or prevented. The latter comparison is somewhat less valid however, since some pollen was present and limited grain formation occurred in the male sterile hybrids.

The apparent inconsistency of the crude protein silage data of Wf 9 x Hy without ears can be explained by a loss of crude protein that occurred during the ensiling process. While not as low in the fresh forage, it is the lowest of the ensiled materials.

Limited feeding trials with sheep indicate no advantage of high stalk sugar silage over normal silage.

This same experiment and feeding trials are being conducted again in 1963-64 in an effort to secure more information concerning the problem.

Table 8. Refractometer readings of corn silages, Centre County, Pennsylvania.

| | % Stalk Sugar | |
|---|---|---|
| | 1962[1] | 1963[2] |
| HS - 50 (isolated) | 14.6 | 15.2 |
| HS - 50 (non-isolated) | 16.6 | 13.1 |
| Wf 9 x Hy (isolated) | 15.6 | 16.3 |
| Wf 9 x Hy (non-isolated) | 14.2 | 11.3 |

1 Average of 10 refractometer readings.
2 Average of 30 refractometer readings.

Table 9. Nutritive Value of Corn Silages (1962-63)

| Silage Description | Digestible Dry Matter % | Digestible Protein % | Digestible Energy % | Digestible Energy Cal./Kg Dry Matter |
|---|---|---|---|---|
| HS 50 - With Ears | 73.4 | 56.5 | 71.9 | 3186 |
| HS 50 - Without Ears | 66.1 | 45.7 | 64.1 | 2744 |
| HS 50 - With Cobs | 71.6 | 56.9 | 70.5 | 3065 |
| HS 50 - Without Cobs | 70.8 | 60.4 | 69.0 | 2994 |
| Wf9 x Hy - With Ears | 76.0 | 56.3 | 74.6 | 3293 |
| Wf9 x Hy - Without Ears | 71.3 | 34.7 | 70.4 | 3085 |
| Wf9 x Hy - With Cobs | 74.6 | 61.6 | 72.7 | 3170 |
| Wf9 x Hy - Without Cobs | 68.7 | 60.4 | 67.0 | 2928 |

Table 10. Proximate Composition of Forages and Silages - (1962-63)
(Dry Matter Basis)

| Forage or Silage Description | Dry Matter % | Crude Protein % | Crude Fiber % | Ether Extract % | Ash % | N-Free Extract % | Energy Cal./Kg |
|---|---|---|---|---|---|---|---|
| **Forages** | | | | | | | |
| HS 50 - With Ears | 28.99 | 7.61 | 19.12 | 2.36 | 3.88 | 67.03 | 4403 |
| HS 50 - Without Ears | 24.65 | 6.94 | 20.97 | 2.15 | 5.75 | 64.19 | 4277 |
| HS 50 - With Cobs | 18.37 | 10.92 | 19.74 | 2.14 | 5.13 | 62.07 | 4343 |
| HS 50 - Without Cobs | 19.69 | 10.92 | 20.65 | 2.02 | 6.01 | 60.40 | 4300 |
| Wf9 x Hy - With Ears | 27.87 | 7.55 | 18.72 | 2.36 | 3.91 | 67.46 | 4406 |
| Wf9 x Hy - Without Ears | 24.37 | 6.31 | 22.39 | 2.20 | 5.26 | 63.84 | 4298 |
| Wf9 x Hy - With Cobs | 18.79 | 9.92 | 19.46 | 2.12 | 4.61 | 63.89 | 4336 |
| Wf9 x Hy - Without Cobs | 20.76 | 9.47 | 21.19 | 1.73 | 5.05 | 62.56 | 4305 |
| **Silages** | | | | | | | |
| HS 50 - With Ears | 28.05 | 7.78 | 21.45 | 3.00 | 3.43 | 64.34 | 4429 |
| HS 50 - Without Ears | 21.72 | 7.62 | 24.71 | 2.38 | 4.44 | 60.85 | 4283 |
| HS 50 - With Cobs | 19.90 | 8.67 | 27.11 | 3.27 | 5.33 | 55.62 | 4346 |
| HS 50 - Without Cobs | 24.10 | 9.44 | 23.74 | 2.93 | 4.93 | 58.96 | 4340 |
| Wf9 x Hy - With Ears | 29.43 | 7.41 | 19.99 | 2.93 | 3.42 | 66.25 | 4413 |
| Wf9 x Hy - Without Ears | 25.48 | 5.14 | 24.40 | 2.28 | 4.51 | 63.67 | 4380 |
| Wf9 x Hy - With Cobs | 22.17 | 8.82 | 25.00 | 3.00 | 4.05 | 59.13 | 4359 |
| Wf9 x Hy - Without Cobs | 23.47 | 9.75 | 24.82 | 2.52 | 4.26 | 58.65 | 4373 |

MORNING SESSION, February 22

The morning session was convened at 9:00 a. m. The first topics for consideration were the committee proposals for 1964.

Committee Proposals for the 100-300 Maturity Series for 1964

Cornell, Penn State, Ottawa and McDonald College will test 23 of the 25 double-crosses produced at Ottawa along with NE144 and Pride 5 as checks. These will be tested in a 5 x 5 lattice design with data recorded on yield at 15 percent moisture, grain moisture at harvest and stalk breakage. The data will be submitted to Penn State for combined analysis.

Cornell and Penn State will test the 75 double-crosses made at Penn State.

No new single-crosses will be produced in 1964 but some of the McDonald top-crosses involving new lines may be grown at Cornell if seed supplies permit.

R. I. Brown
W. F. Craig
H. L. Everett
W. I. Thomas
L. S. Donovan, Chairman

Committee Proposals for the 400-600 Maturity Series for 1964

The cooperative testing program will consist of three endeavors in 1964: First, the double-cross combinations made up in 1963 on the basis of predictions from 1962 data will be grown at all locations expressing an interest. To date, New York, Pennsylvania, and Cooperative Corn Research Project have requested seed. Massachusetts, Michigan, and other potentially interested stations will be surveyed. The double-crosses to be included are as follows:

| Entry | Am't. Seed lbs. | State-Location-Kernel No. desired | | | |
|---|---|---|---|---|---|
| | | Pa. 6 reps 200 K ea. | CCRP 100 K | Yegian | Rossman Neal |
| (Pa41 x W182D)(Pa409 x NY821) | 1½ | | | | |
| (Pa41 x W182D)(ES55-157 x NY821) | 1½ | | | | |
| (Pa409 x NY821)(NYD410 x W182D) | 2 | | | | |
| (Pa41 x NY821)(Pa409 x NY821) | 3 | | | | |
| (ES55-157 x NY821)(NYD410 x Pa409) | 1 | | | | |
| (NYD410 x W182D)(ES55-157 x Pa409) | 2½ | | | | |
| (NYD410 x W182D)(Pa41 x NY821) | 2½ | | | | |
| (NYD410 x W182D)(Pa55 x NY821) | 1 | | | | |
| (ES55-157 x Pa409)(Pa41 x NY821) | 2½ | | | | |

| Entry | "Am't. "seed "lbs. | State-Location-Kernel No. desired 'Pa.6 reps' CCRP '200 K ea.' '100 K ea! 'Yegian' 'Rossman 'Neal |
|---|---|---|
| (ES55-157 x Pa409)(W182D x NY821) | 2 | |
| (NYD410 x Pa409)(Pa41 x NY821) | 2 | |
| (NYD410 x Pa409)(W182D x NY821) | 2 | |
| (Pa41 x NY821)(ES55-157 x PaB8B) | 2 | |
| (Pa41 x NY821)(C153 x Pa409) | 2½ | |
| (W182D x NY821)(ES55-157 x PaB8B) | 2 | |
| (W182D x NY821)(C153 x Pa409) | 2 | |
| (ES55-157 x PaB8B)(C153 x Pa409) | 2½ | |
| (ES55-157 x PaB8B)(Pa55 x NY821) | 2½ | |
| (C153 x Pa409)(Pa55 x NY821) | 3 | |
| (C153 x Pa409)(PaB8B x NY821) | 2 | |
| (Pa55 x NY821)(Pa409 x W182D) | 2½ | |
| (Pa55 x NY821)(Pa41 x Pa409) | 2 | |
| (PaB8B x NY821)(Pa41 x Pa409) | 2½ | |
| (NYD410 x NY821)(Pa41 x Pa409) | 2 | |
| (Pa41 x Pa409)(W182D x NY821) | 3 | |
| (Pa41 x Pa409)(PaB8B x NY821) | 2 | |

Produced in Pennsylvania:

(C153 x Pa409)(Pa55 x NY821)
(C153 x Pa409)(W182D x NY821)
(ES55-157 x Pa409)(W182D x NY821)
(Pa55 x NY821)(Pa409 x W182D)
(NYD410 x Pa409)(Pa41 x NY821)
(NYD410 x NY821)(Pa409 x W182D)
(Pa41 x W182D)(Pa409 x NY821)
(Pa409 x W182D)(PaB8B x NY821)
(NY821 x ES55-157)(W182D x NYD410)
(PaB8B x ES55-157)(Pa41 x NY821)

Second, the two diallel series grown in 1963 and reported on earlier, will be used as a basis for double cross predictions with relatively early maturity as indicated by percent water at the time of harvest used as a further restriction. Twelve or more promising combinations including the four listed below will be produced on this basis by Pennsylvania, New York, and Cooperative Corn Research Project.

| | | Bula | $H_2O$% predicted |
|---|---|---|---|
| (1) | (NY821 x Pa41)(C153 x NY511) | 94.8 | 24.3 |
| (2) | (W144 x Pa41)(NY821 x NY511) | 93.8 | 26.8 |
| (3) | (W144 x NY821)(C153 x Pa41) | 92.0 | 26.3 |
| (4) | (NY821 x NY511)(C153 x Pa41) | 91.9 | 25.3 |

Third, 20-30 new inbreds will be collected at Pennsylvania and New York to be top-crossed to a specific single cross (Pa11 x Pa54) and to the double cross Michigan State 250 (Oh51 x R53)(MSW10 x MS206). These materials will be planted in replicated yield trials in 1965. In addition to the new lines (8-10 from New York and Pennsylvania and any interesting inbreds from other members or the North Central States). Three "control" inbreds will be used in these crosses: Ia.B8, Pa32, and NY821.

J. H. McGahen
C. E. Manchester
H. Yegian
H. L. Everett, Chairman

## Committee Proposals for the 700-900 Maturity Series for 1964

The sole activity in this series in 1963 was a cooperative test of about 110 experimental double crosses made up and distributed by Pennsylvania. New Jersey and Maryland tested these under severe drought conditions which resulted in a very large experimental error. Pennsylvania processed the data by individual and by combined locations. Copies of the combined data were furnished to the cooperators and to other interested parties so there seemed no need to include these in the Conference proceedings.

In 1964 the Cooperative Corn Research Project, New Jersey and Pennsylvania will use 3 testers, viz. B37 x Oh43, C103 x B14 and C103 x Pa887P, on which each will cross 10 new inbred selections of its own choice. These are to be tested in 1965.

W. I. Thomas
J. Buchert
R. G. Rothgeb
J. C. Anderson, Chairman

## Committee Proposal on Diseases and Pests

No regional studies are proposed for 1964 but each State will continue their individual efforts in this area.

Committee on Corn Silage Research - 1964 plans

Research planned for 1964 includes the following general categories:

1. Regional field trials
2. Quality evaluation through animal digestion trials
3. Quality evaluating by chemical tests
4. On-the-farm and extension evaluations
5. Selection in diverse germ plasm and breeding methodology studies.

Eight of the cooperating agencies who had representatives at the Conference intend to be active in one or more categories. In addition, three states not present have expressed interest in cooperation if a Regional project should be approved.

The committee recommends that the following hybrids be used as check entries in all appropriate silage testing procedure:

| | |
|---|---|
| Early hybrids | Pa 290, Cornell M-3 |
| Medium hybrids | Cornell M-3, Pa 602A |
| Late hybrids | Pa 602A, N.J. 9 |
| Male sterile hybrids | Pa 602A, N.J. 9 |

Discussion of the proposed regional project outline suggested that paragraphs on silage quality evaluations, breeding methods, and selection in diverse germ plasm should be emphasized.

Director Fortmann has suggested the following procedure, should the Conference desire to formalize the silage project:

That a letter of intent from the NECIC through the Silage Committee be directed to the Committee of Three of the Northeastern Experiment Station Directors requesting consideration of organization of the Northeast Silage Corn Research Project under the NE Coordination format for 1964-65. Further, that they be informed of our intent to submit a formal research proposal to the NERR Committee for consideration of activation

July 1, 1965, as a NE Regional Research Project.

The Silage Committee endorses this suggestion, and asks that the NE-24 forage quality Evaluation Committee be apprised of this proposal by Director Fortmann.

It is suggested that representatives from New Jersey and Maryland be added to the committee.

H. M. Yegian
Cliff Manchester
Melvin Johnson
Loren Donovan
Walter Thomas
Ronald Anderson, Chairman

R. A. Anderson MOVED "That the Committee on Silage send a letter of notification to Directors Fortmann, Kennedy and Cobble of the intent of the Northeastern Corn Improvement Conference to organize silage research under NEC Regional format this year with a formal proposal to be submitted to NERR for consideration at their August meeting for possible activation in 1965".

Motion SECONDED and PASSED.

Chairman Thomas reported on a series of new germplasm pools which are available for distribution. The parentage of these is listed below:

1. Hopi Selection -- Original seed from Hopi tribes in Southwestern states, flour kernel type (AES 500-700 maturity)

2. 90-day selection -- Early yellow dent from northern U.S. (AES 400-500 maturity)

3. Gehu selection -- Early flint from northern U. S. Now largely dent. (AES 400-500 maturity)

4. Indian selection -- (Original seed from several Indian tribes in Southwestern types, four kernel types, considerable color other than yellow. (AES 800-900 maturity)

5. Texas selection -- Original seed -- white dent hybrids. Now largely yellow. (AES 800-900 maturity)

6. Southern white selection -- Original seed -- collection of about 70 white dent open pollinated varieties from 17 southeastern states. Now largely yellow. (AES 800-900 maturity)

All lots were top crossed to Minn. 13, Lancaster Surecrop and locally adapted yellow dents in 1954 and 1955. From 1956 through 1963, all lots were carried as open pollinated stocks. For 1960-1963, agronomically desirable phenotypes were selected. Seed ears from vigorous, strong stalks, tendency to more than 1 ear, apparent freedom from pests, normal leaf color.

These selections were made by Dr. H. B. Sprague and may be considered to be germ plasm reservoirs, suitable for search for new combinations of heritable traits. 1000 kernels available for each, on request to W. I. Thomas, 119 Tyson Bldg., Pennsylvania State University, University Park, Penna. 16802.

The Chairman then called for the report of the Nominating Committee. This committee proposed R. G. Rothgeb as Vice-Chairman for 1964. There being no nominations from the floor the secretary was instructed to cast a unanimous ballot for Dr. Rothgeb.

Chairman Thomas expressed his appreciation to committee members for their support during the year and then turned the meeting over to the new Executive Chairman, Dr. R. I. Brawn.

Dr. Brawn made a number of new committee assignments which are recorded in the section on Officers and Committee Members for 1964-65.

It was MOVED by J. C. Anderson and seconded by L. S. Donovan that the next meeting be held in New York City some time between February 19 and 27, the exact time and place to be left to the discretion of the Chairman.

Motion passed.

It was MOVED by H. L. Everett that the Committee on Nomenclature of Cytoplasmic Sterility be retired. Motion seconded and passed. There being no further business the meeting was adjourned at 11:30 a. m.

# OFFICERS AND COMMITTEE MEMBERS, 1964-1965

Administrative Advisor
H. R. Fortmann

Executive Committee
R. I. Brawn
R. G. Rothgeb
W. I. Thomas

Committee on Registration of NE Hybrids
R. G. Rothgeb, Chairman
J. C. Anderson
H. L. Everett
W. I. Thomas

Committee on Uniform Tests of 100-300 Maturity
L. S. Donovan
H. L. Everett
W. I. Thomas
R. I. Brawn
W. F. Craig

Committee on Uniform Tests of 400-600 Maturity
H. L. Everett
C. E. Manchester
H. M. Yegian
J. H. McGahan

Committee on Uniform Tests of 700-900 Maturity
J. C. Anderson
J. Buchert
R. G. Rothgeb
W. I. Thomas

Committee on Diseases and Pests
M. W. Johnson, Chairman
J. C. Anderson
C. C. Wernham
C. E. Boothroyd
J. L. Peterson
R. G. Rothgeb
R. H. Cole

Committee on Inbred Release Policy
W. I. Thomas, Chairman
J. C. Anderson
H. L.Everett
D. L. Matthews

Committee on Corn Silage

R. W. Anderson, Chairman
L. S. Donovan
H. W. Johnson
C. E. Manchester
W. I. Thomas
H. M. Yegian
J. C. Anderson
R. G. Rothgeb

## ROSTER OF ATTENDANCE

| | | |
|---|---|---|
| **Canada** | | |
| Brawn, R. I. | McDonald College | Montreal |
| Donovan, L. S. | Central Expt. Farm | Ottawa |
| **Delaware** | | |
| Cole, R. H. | University of Delaware | Newark |
| **Maryland** | | |
| Rothgeb, R. G. | University of Maryland | College Park |
| Sprague, G. F. | ARS, U.S.Dept. Agr. | Beltsville |
| **Massachusetts** | | |
| Manchester, C. E. | Coop. Corn Res. Project | W.Springfield |
| Matthews, D. L. | " " " " | " |
| **New Jersey** | | |
| Anderson, J. C. | Rutgers University | New Brunswick |
| **New York** | | |
| Anderson, R. E. | Cornell University | Ithaca |
| Boothroyd, C. E. | " " | " |
| Crowder, L. V. | " " | " |
| Everett, H. L. | " " | " |
| Thompson, J. C. | " " | " |
| Stiles, J. W. | G.L.F. | " |
| Buchert, J. G. | Coop. Corn Res. Project | Palmyra |
| **Pennsylvania** | | |
| Barber, W. D. | Penn State University | Univ. Park |
| Craig, W. F. | " " " | " |
| Creech, R. G. | " " " | " |
| Fortmann, H. R. | " " " | " |
| McGahen, J. H. | " " " | " |
| Thomas, W. I. | " " " | " |
| **West Virginia** | | |
| Johnson, M. W. | Univ. of West Virginia | Morgantown |